FE(VI) AS A POSSIBLE OXIDANT ON THE MARTIAN SURFACE.

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The Viking Labeled Release and Gas Exchange experiments indicated a highly oxidizing reactive soil on Mars surface. Here a hypothesis is put forward, on the possible involvement of highest oxidation state iron, ferrate(VI), FeO_4^{2-}, as a compound contributing to the oxidizing power of Martian soil. Ferrate(VI) formation and accumulation in Martian soil are discussed, and experimental data presented on its spectral characterization and behavior under conditions simulating the Viking experiments.Fe(VI) can be synthesized under strong alkaline conditions from Fe(III) in the presence of strong oxidants. The high intensity UV flux on Martian surface can generate free radicals with very high redox potential, which will interact with Fe(II) and Fe(III) presented on Martian surface and give as a product Fe(VI). Dark purple color of ferrate(VI) is due to its absorption spectrum, with a peak at 507 nm. This spectrum makes Fe(VI) very distinct from other forms of dissolved iron, and absorption spectrum is an appropriate tool for Fe(VI) identification. In ferrate(VI) reflectance spectrum the band at 1.6 μm is a characteristic one, and it can be used as a marker to search for the presence of Fe(VI) on the Martian surface. Mössbauer spectroscopy is the most powerful approach to the identification of iron oxidation states. It is especially important in the context of these studies since a compact Moessbauer instrument has been developed for the future Mars exploration. Moessbauer spectrum of potassium ferrate(VI) has a singlet line with a negative isomer shift of -0.91 mm/s. X-ray spectra (XANES) are sensitive to iron oxidation state and the three-dimensional geometry of its ligands, thus constituting a sensitive approach for Fe(VI) identification in returned samples from future Mars missions. In our experiments, addition of aqueous solutions of formate and/or lactate to powdered potassium ferrate(VI) resulted in the release of carbon dioxide. At the same time, some dioxygen was formed, apparently due to a concomitant reaction with water. Preheating ferrate considerably inhibited carbon dioxide evolution. All these observations are in line with the results of Viking Labeled Release Experiments.